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Practical application of the EMC Directive to broadband cable networks – a technical perspective

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Practical application of the EMC Directive to broadband cable networks – a technical perspective

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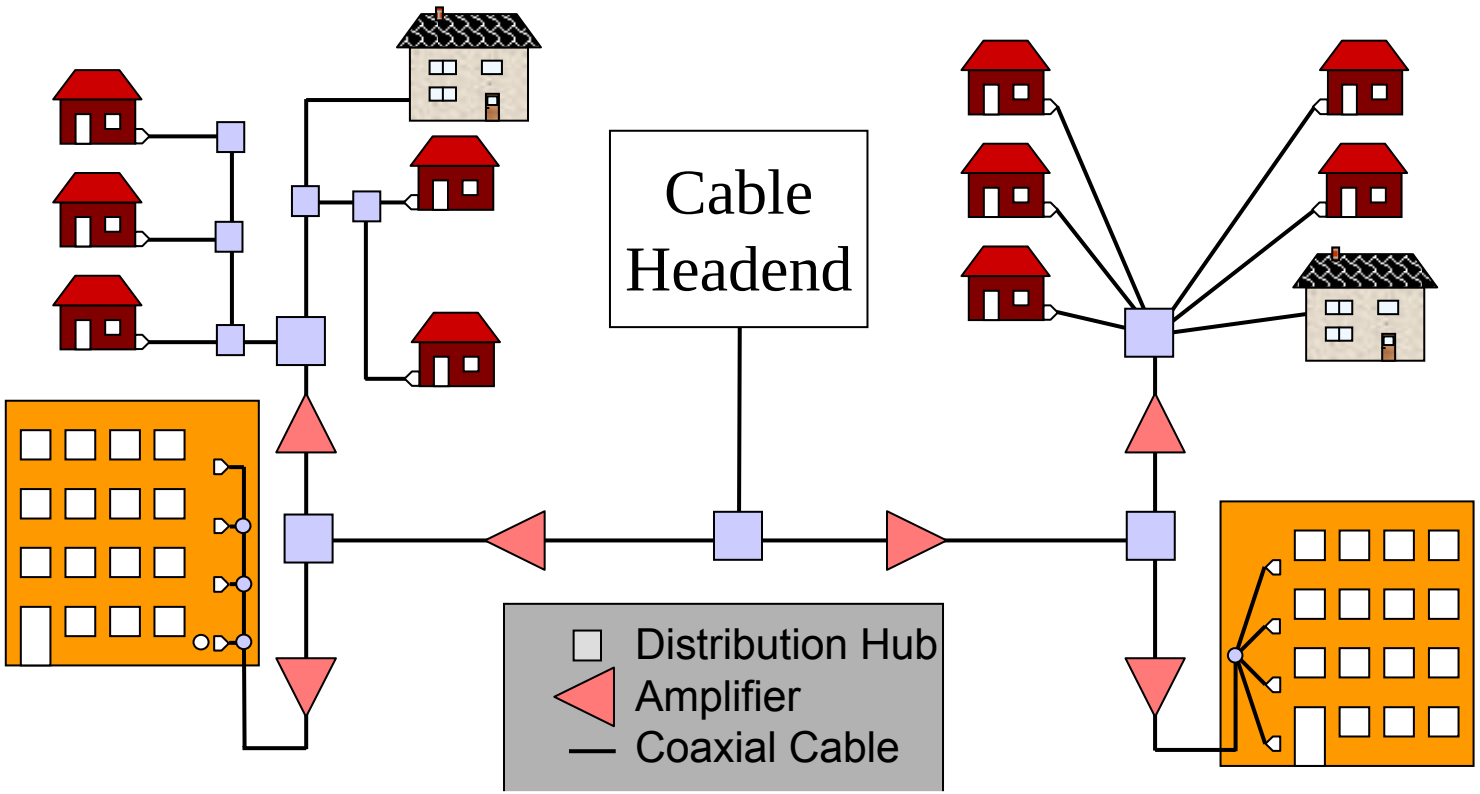
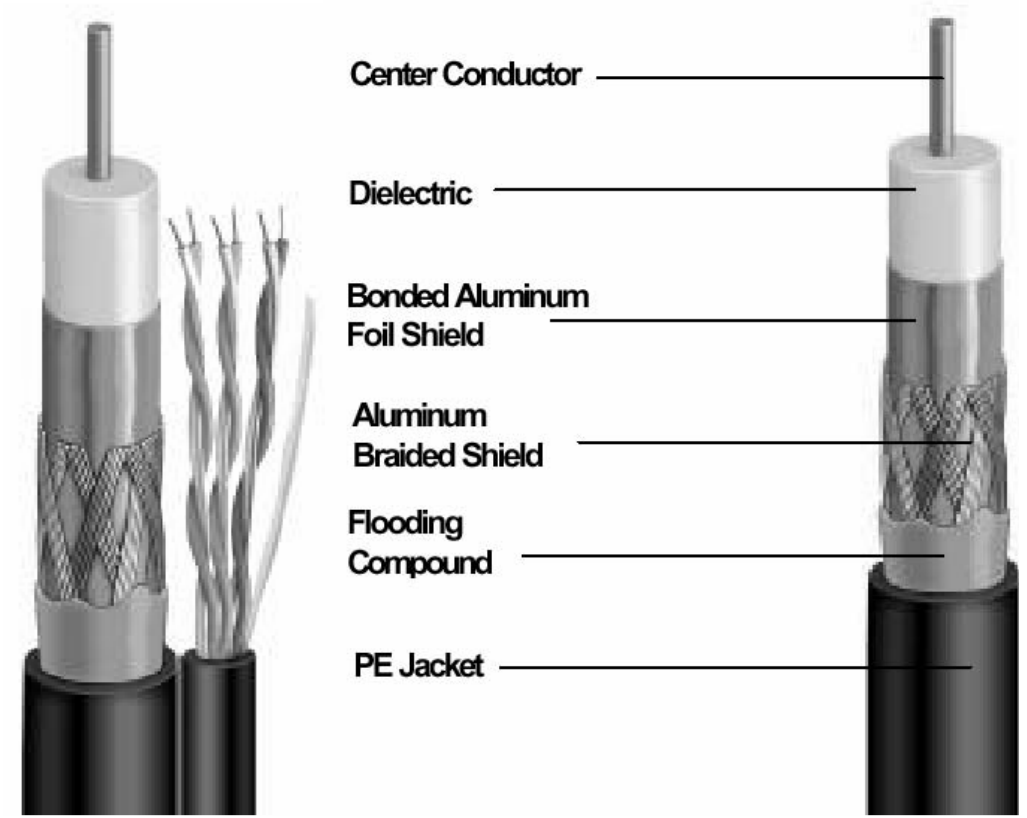
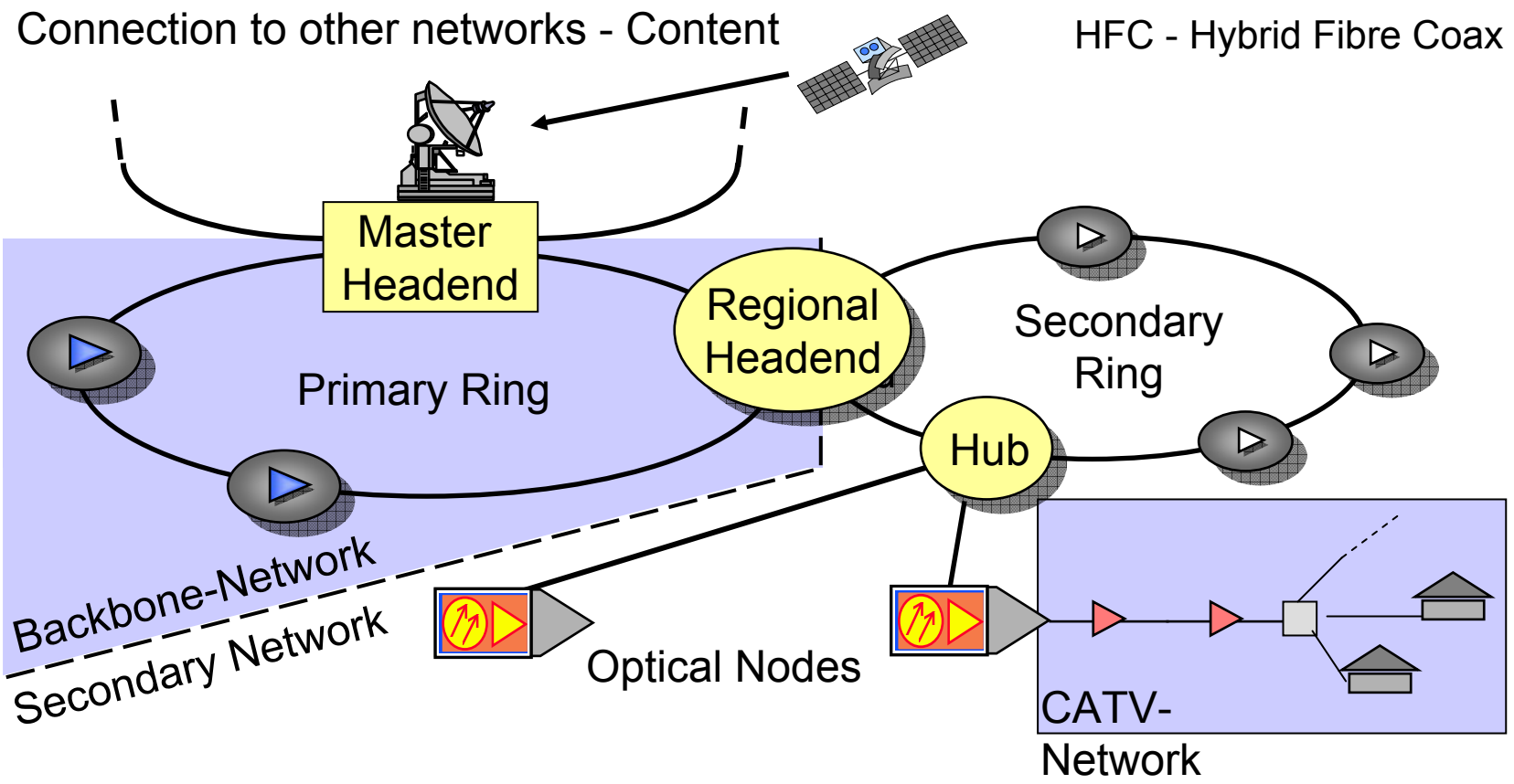
Typical CATV Network Configuration – Tree and Star Structure



Coaxial Cable utilised in CATV Networks

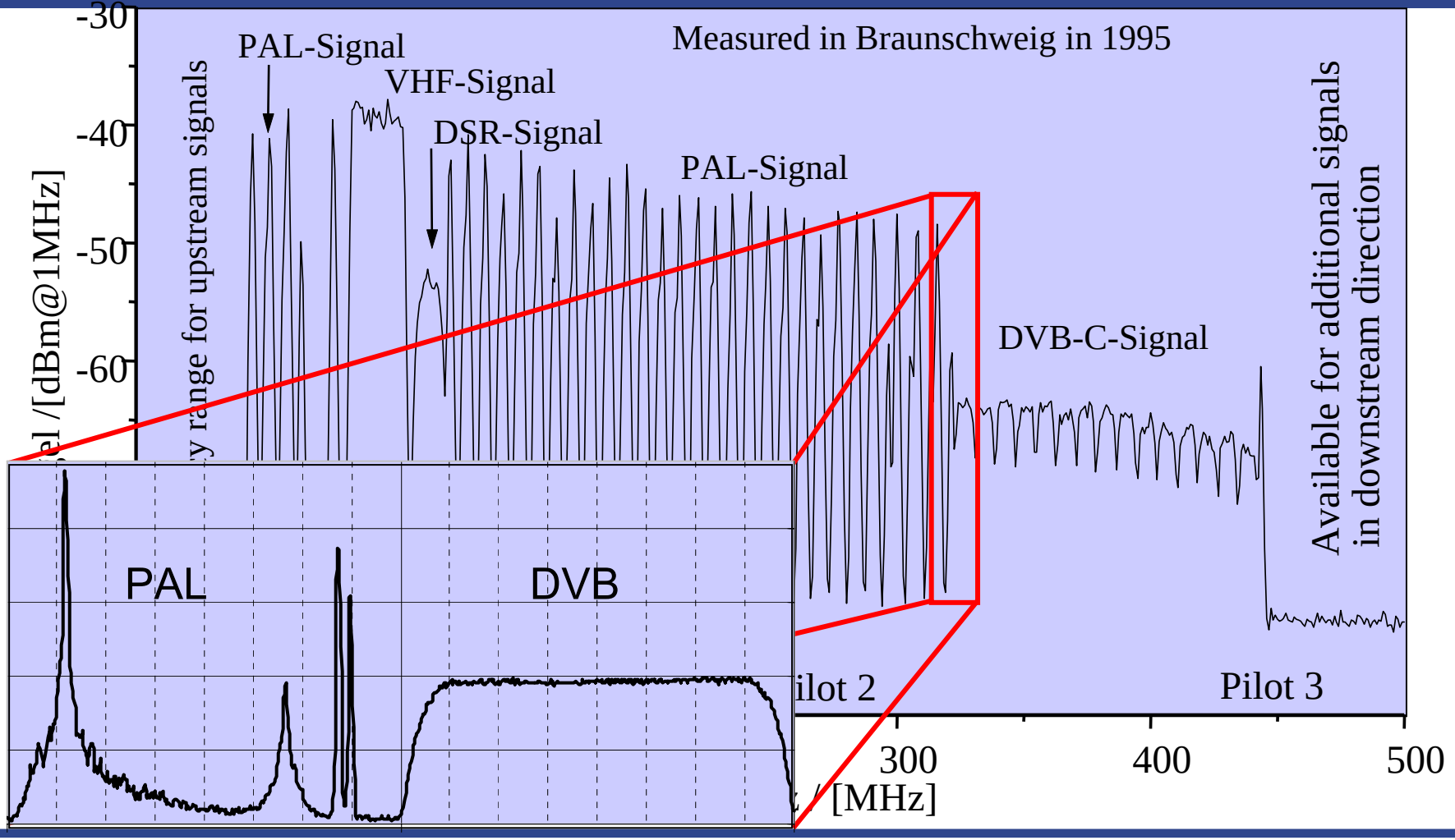


Structure of a Modern HFC Network



Quelle: Motorola

Typical CATV Frequency Usage



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- Network configuration
- Standardisation and technology issues for broadband cable networks
- Good engineering practice
- Network ownership
- Conclusions

Essential Requirements - General

- Conformity with Directive's essential requirements facilitated by standards which address:
  - Low network egress (low radiation) — helps coexistence with radiocommunications and other ECNs
  - Low network ingress (high immunity) – helps the provision of high quality services to customers

EMC Standardisation for Cable by CENELEC

- EN 55022 – harmonised standard for IT equipment
  - Used as a reference by the IT sector
  - Provides presumption of conformity
- EN 50083-2 – harmonised standard for cable network apparatus
  - Used as reference by the cable industry
  - Provides presumption of conformity
  - Provides greater protection for radiocommunications services

Standardisation (cont.)

BUT … that‘s not all !

- The cable industry has developed a voluntary network standard EN 50083-8
  - Also used as reference by the cable industry
  - Covers immunity as well as radiation aspects
  - Limits similar to those in the U.S.

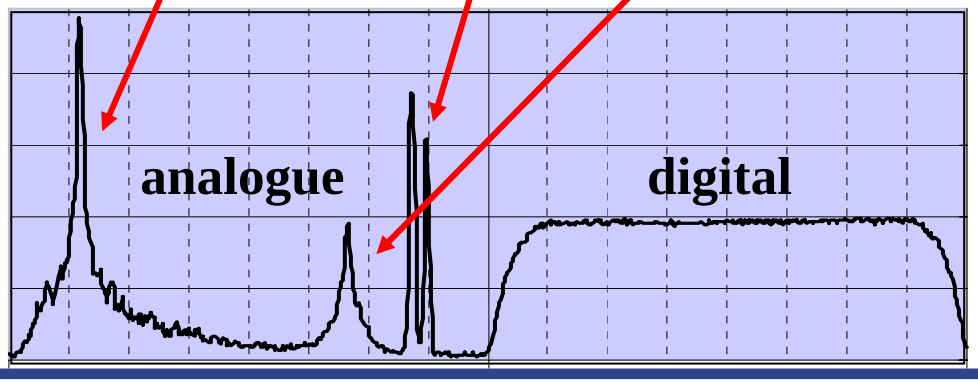
Standardisation (contd.)

AND furthermore …

- The cable industry:
  - Is developing in the course of CENELEC TC 209's standardisation program "guidelines for securing the EMC characteristics of cable networks during planning, installation and maintenance"
  - Has encouraged installers to adopt a quality regime
  - which includes in-home networks based on coaxial cables

Technology

- Digitisation brings advantages
- The absence of vision, sound and colour sub-carriers reduces the possibility of disturbance
- Digital modulation methods spreads energy across a broad bandwidth



Technology (contd.)

- Frequencies in guided media not radio and therefore not protected from radio services
- There maybe a limit to practicable immunity improvement especially for in-home networks
- Broadband cable provides competition
- General objective is maximising ‘on-air’ frequency usage – i.e. increasing spectrum usage and radio penetration
- Should frequency usage on cable, at least, be a (minor) factor considered in the planning of radio systems?

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Good Practice?

- Network build and roll-out
- Network modification
- Network maintenance & repair
- Customer education/support

Network Build/Modification

- Quality of material
  - In compliance with EN 50083-2
- Quality of installation
  - In compliance with EN 50083-8
- Applies to all networks including in-home

Network Maintenance & Repair

- Network monitoring – several methods
  - Continuous monitoring:
    - ✓ Return path measurements of ingress likely to indicate egress and lack of immunity
  - Samples:
    - ✓Equipping maintenance staff with monitors to identify egress
- Efficient call centres
- Speedy response to fault situations

Portable Equipment

- Portable unit for finding individual leaks - example

Trilithic Leakage Detector – Ingress Locator

Measuring Equipment

- Equipment can be installed in an aircraft or ground vehicle
- Flyover measurements linked to GPS positional information

Very cost intensive measure!

Not suitable for continuous monitoring purposes!

Immunity of & Ingress to Cable Systems

- Ingress problems to cable observed
  - DAB interference to analogue TV
  - DVB-T interference reports in Germany, France , Belgium, The Netherlands, …
    - ✓Analogue TV but also digital services conceivable
    - ✓Telephone & data services
  - Power-line interference
    - ✓FICORA Report – Finland
    - ✓Ingress into cable upstream used for telephone & data services
    - ✓Coupling via the power mains conceivable

Customer Education

- Egress has the potential to cause serious problems
- Ingress can cause degradation in the network and in other in-home networks
- Self install has potential problems
- Use of inferior cable worrying
- End users need to be aware of the issues – ‘health warnings’ on bills

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Network Ownership

- Cable operator's network responsibility ends at some point where network ownership changes hands i.e. in customers' homes
- In-home networks are generally under the control of the property owner
  - Operator has little influence on the quality of the installation and material used
- TV-set and VCR equipment cords (ready made connecting devices)
  - Weakest link, most worrying source of ingress and egress
  - Bad quality of material in retail shops
  - Withdrawn from the Directive

Network Ownership

- Consequences
  - Poor in-home networks can lead to excessive egress (and ingress)
  - Effect can be cumulative
  - Public are not EMC aware
  - Network owners subject to regulatory process after transposition
  - Resolution?

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Conclusions

- Broadband cable networks
  - Internet, TV, and telephone services
  - CENELEC Standards used as industry references
  - Installation according to good engineering practice
  - Maintenance regime to facilitate low radiation and high immunity
  - Ownership situation may cause problems for trouble shooting at customer premises

→New EMC Directive supported by the cable industry

Thank You